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UNITED STATES ARMY AVIATION TEST BOARD
Fort Rucker, Alabama 36362

STEBG-TD

22 DEC 1965

SUBJECT: Final Report of Test, "Service Test of XM-151 Warhead
for 2.75-Inch FFAR," RDT&E Project No. 1X141806D13608,
USATECOM Project No. 4-4-1541-17

Ad475517

TO: See Distribution

Subject report is forwarded for information and retention.

Raymond E. Johnson

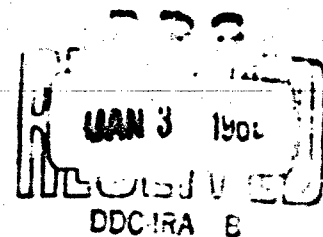
2 Incl

1. Report
2. USATECOM action letter

RAYMOND E. JOHNSON
Colonel, Artillery
President

Distribution:

See page 6 of inclosure 1



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DEPARTMENT OF THE ARMY
UNITED STATES ARMY AVIATION TEST BOARD
Fort Rucker, Alabama 36362

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14 OCT 1965

SUBJECT: Final Report of Test, "Service Test of XM-151 Warhead
for 2.75-Inch FFAR," RDT&E Project No. 1X141806D13608,
USATECOM Project No. 4-4-1541-17

TO: Commanding General
US Army Test and Evaluation Command
ATTN: AMSTE-BG
Aberdeen Proving Ground, Maryland 21005

1. References.

a. Preliminary Operating Maintenance Manual 1340-222-12
(PA-DB7), "Warhead, 2.75-Inch Rocket, High Explosive: XM-151,"
August 1964.

b. Plan of Test for Integrated Engineering and Service Test
of XM-151 Warhead for 2.75-Inch FFAR Rocket, US Army Aviation
Test Board, 24 December 1964.

c. Plan of Test for Integrated Engineering Service Test of
XM-151 Warhead for 2.75-Inch FFAR Rocket, Development and
Proof Services, February 1965.

d. Final Report of Engineering Test of XM-151 Warhead for
2.75-Inch FFAR Rocket, Development and Proof Services, October
1965.

2. Authority.

a. Directive. Letter, AMSTE-BG, Headquarters, US
Army Test and Evaluation Command, 24 November 1964,

FOR INFORMATION ONLY
ACTION BY HIGHER HEAD-
QUARTERS PENDING

STEBG-TD

SUBJECT: Final Report of Test, "Service Test of XM-151 Warhead for 2.75-Inch FFAR," RDT&E Project No. 1X141806D13608, USATECOM Project No. 4-4-1541-17

subject: "Test Directive, USATECOM Project No. 4-4-1541-16/17, Integrated Engineering/Service Test of XM-151 Warhead for 2.75 Inch FFAR Rocket."

b. Purpose. To determine whether the XM-151 warhead when assembled with the 2.75-inch rocket motor and employed from the UH-1 helicopter is suitable for Army use.

3. Background. The 2.75-Inch FFAR, with the standard MK 1 warhead, is presently being used in the Interim Area Rocket System, Phase I of a program to arm Army aircraft with air-to-surface rockets. Warheads for the 2.75-inch rocket, Phase II of the Program, are to provide improved effectiveness. The XM-151 warhead is being developed by Picatinny Arsenal to meet this requirement and is ultimately to replace the standard MK 1 warhead. The in-flight portion of the test was initiated on 21 July 1965 at Aberdeen Proving Ground, Maryland, and was completed on 14 August 1965.

4. Findings. A total of 628 rockets with the XM-151 warhead and XM-423E1 fuze was fired during the in-flight portion of the integrated test using the XM-3 subsystem. The helicopter was instrumented during the firing of approximately twenty-five percent of these rockets in order to determine ballistic data. A preliminary table of recommended sight settings for various ranges, altitudes, and airspeeds is included in the final engineering report of test (reference d).

a. No in-flight center-of-gravity (c.g.) problems were encountered in any of the test configurations. Inclosure 1 contains detailed weight and balance data.

b. No malfunctions attributable to the performance characteristics of the XM-151 warhead were encountered. All XM-151 warheads which were initiated by proper fuze action detonated high order. No rocket motor malfunctions were noted. Four XM-3 subsystem malfunctions occurred due to improper rocket seating or blow-back of the firing pin contact assembly.

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c. Turn-around time for completely reloading 48 rockets in the XM-3 subsystem utilizing two men averaged 20 minutes. This time is based on use of pre-assembled rockets stockpiled adjacent to the loading site.

d. Night firing of the XM-151 warhead presented no change from night firing of other warheads. Illumination created by burning of rocket motors caused no significant reduction of night vision when rockets were fired in single pairs.

e. Noise and gas contamination levels are tabulated in inclosure 2. Peak sound-pressure levels under all conditions tested were in excess of the limits specified in TB Med 251, 25 January 1965. Concentrations of carbon monoxide in some firing conditions exceeded the threshold limit of 0.010 percent as specified in TB Med 265. (The American Conference of Government and Industrial Hygienists places threshold limit values at 0.005 percent.) Although exposure time was brief at these high concentration levels, safety problems could be encountered as a result of repeated exposure during the firing of several complements of rockets.

f. The helicopter incurred skin damage attributed to warhead fragmentation. This hit resulted from firing at 300 meters range, V_{ne}(100 knots) and an altitude of approximately 60 feet. Main rotor blade damage was incurred from debris from the rocket motor on one occasion, necessitating the change of one blade. An observer was hit by a rocket motor closure disc which entered the pilot's window, struck the observer on the right arm, and inflicted a slight bruise. A detailed discussion of aircraft damage is contained in the final engineering report of test (reference d).

g. An armament specialist, MOS 45J20, required no additional training for handling, loading, and maintaining the XM-151.

h. No maintenance of the XM-151 warhead was required during the test. Maintenance of the XM-3 subsystem consisted of normal cleaning of tubes.

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i. A detailed evaluation is contained in the final engineering report of test (reference d). Results of the engineering test were reviewed. The following were determined:

(1) The XM-151 warhead met all applicable requirements of the test when fired at ranges in excess of 300 meters.

(2) The XM-151 warhead was compatible with the rocket motor MK 40 Mod O.

(3) A preliminary table of recommended sight settings for various ranges, airspeeds, and altitudes was prepared from the firing test data.

5. Conclusions.

- a. The XM-151 warhead is suitable for Army use.
- b. Damage due to hits from warhead fragmentation may be incurred at ranges of 300 meters or less.
- c. Unprotected helicopter crew members could sustain eye injury from rocket debris entering the helicopter.
- d. Helicopter crew members without ear protection could sustain ear damage caused by high sound-pressure levels during firing.
- e. Safety problems could be encountered as a result of repeated brief exposures to high concentration levels of carbon monoxide.

6. Recommendations. It is recommended that:

- a. The XM-151 warhead be considered suitable for Army use.
- b. Employment of the XM-151 warhead at ranges of 300 meters and less be limited to tactical necessity.

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c. Eye protection (i. e., helmet visor) be employed during all
rocket firing.

d. Ear protection be employed when firing the 2.75-inch FFAR.

e. Further studies be conducted on concentrations of carbon
monoxide in crew compartments of UH-1 helicopters.

2 Incl

as


RAYMOND E. JOHNSON
Colonel, Artillery
President

DISTRIBUTION:

(see page 6)

WEIGHT AND BALANCE DATA

FOR UH-1B S/N 60-3588

WITH XM-3 SUBSYSTEM

	<u>Weight</u> <u>(lb.)</u>	<u>Moment</u> <u>(lb.)</u>	<u>C.G.</u> <u>(in.)</u>
<u>Configuration No. 1</u>			
Pilot, copilot, crew chief, full fuel, all test items (including instrumentation), and subsystem fully loaded	8,359	10,845	129.7
<u>Configuration No. 2</u>			
Same as above except air- craft at maximum gross weight	8,500	10,996	129.4

End 1

NOISE MEASUREMENTS AND CARBON MONOXIDE

TEST RESULTS FURNISHED BY

DEVELOPMENT AND PROOF SERVICES

1. Sound Measurements.

a. Maximum sound-pressure levels (SPL) recorded during the firing of the XM-3 weapon system were as follows:

<u>Conditions</u>	<u>No. of Rockets Fired From Each Pod</u>	<u>Peak Sound-Pressure Levels in db re 0.0002 Microbar</u>	
		<u>Pilot's Ear</u>	<u>Crew Compartment</u>
Windows and doors closed	1	145	150
Windows on, pilot and co-pilot doors open, crew doors closed	1	160	152
Windows on, pilot and co-pilot doors open, crew doors open	1	161	168
Windows on, pilot and co-pilot doors open, crew doors removed	6	161	167

b. Instrumentation.

(1) Measurements were taken at both locations simultaneously by using two systems consisting of a sound-level meter, Type GR1551-C; condenser microphone system, Type GR1551-PI; and an impact analyzer, Type GR 1556-B.

(2) The two sound-pressure level measuring systems used are the only portable instrumentation available for in-flight measurements. They have flat responses through the frequency range 20 cps to 18 kc.

Incl 2

The user of the above data should be aware that the peak levels reported are accurate only if the rise time of the transient signal was greater than 50 microseconds. If the rise time was less than 50 microseconds, the reported values would be in error and on the low side.

(3) The microphones were placed at the pilot's right ear and at the right ear of a person occupying the extreme right side of the seat in the crew or cargo compartment of the ship.

(4) A laboratory check of the instrumentation was made before and after the tests. A signal of known sound-pressure level and frequency was applied to the microphone systems at the time of the test.

2. Carbon Monoxide Measurements.

a. Concentrations of carbon monoxide gases measured while firing the XM-3 weapon system were as follows:

<u>Condition</u>	<u>No. of Rockets Fired From Each Pod</u>	<u>Percent Carbon Monoxide</u>	
		<u>Copilot Position</u>	<u>Crew Position Ext. Left Side Seat</u>
Windows and doors closed	1	.000 to .001	.001 to .0025
Windows on, pilot and copilot doors open, crew doors closed	1	.000 to .005	.000 to .005
Windows on, pilot and copilot doors open, crew doors open	1	.005 to .0075	.005 to .010
Windows on, pilot and copilot doors open, crew doors removed	6	.010	.010 to .020

b. Two MS/A Catalog No. 47133 Carbon Monoxide Testers were used to obtain the above readings. Air was sampled for approximately 40 seconds after firing commenced with windows open, doors closed,

and with windows and doors open; approximately 80 seconds' sampling time was obtained with both windows and doors closed.

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DEPARTMENT OF THE ARMY
HEADQUARTERS, U.S. ARMY TEST AND EVALUATION COMMAND
Aberdeen Proving Ground, Maryland 21005

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for 2.75-Inch FFAR," RDT&E Project No. 1X141806D13608,
USATECOM Project No. 4-4-1541-17**

**TO: Commanding General
U. S. Army Materiel Command
ATTN: AMCPM-AI
Washington, D. C. 20315**

1. Reference: Letter, AMSTE-BG, dated 28 October 1965, subject: Type Classification of Warheads HE, XM151, and WP, E-13 for 2.75-Inch Rocket, USATECOM Project No.'s 4-4-1541-16/17/20/21, RDT&E No.'s 1X141806D136.06/.10 (U).

2. Subject report is forwarded for your information. Correct altitude stated as 10 feet on page 3, paragraph 4f to 100 feet.

3. Above reference recommended standard A category as the position of this Command relative to type classification of the XM151 warhead.

FOR THE COMMANDER:

1 Incl
Final Report (5 cys)

/s/ David M. Kyle
/t/ DAVID M. KYLE
Colonel, GS
Dir, Avn Mat Testing

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(see page 2)

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